Headquarters U.S. Air Force

Integrity - Service - Excellence

The Air Force S&T Budget & Investment Focus

U.S. AIR FORCE

Mark Stephen, Col, USAF
Chief, Science and Technology Division
Deputy Assistant Secretary (Science, Technology & Engineering)
April 21, 2004

Air Force Science and Technology (S&T) Mission

Leading the discovery,

development, and demonstration

of affordable

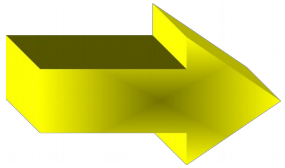
technologies for our air and

space forces

Warfighter Capability Focus

U.S. AIR FORCE

Outline



- Transformation
- Legacy S&T
- Near-Term S&T
- Invest in Future Warfighter Capabilities
- Summary

U.S. AIR FORCE

DoD Quadrennial Review (QDR) Transformational Goals

Emanating From Transformation Pillars

U.S. AIR FORCE

Air Force Transformation

- Begins with Joint Warfighters analyzing the joint operational environment to determine Desired Effects
- Air Force explores and implements solutions for Desired Effects via:
  - **Air Force Core Competencies**
  - **Air Force Concepts of Operations (CONOPs)**
  - **Air Force Transformational Goals**
- This will produce transformational changes in New Technologies that are incorporated into deploying our Air Expeditionary Forces

U.S. AIR FORCE

Three Core Competencies

The U.S. Air Force's fundamental service to the nation is in its ability to develop, train, sustain, and integrate all the elements of air and space power to provide its three core competencies:

- **Developing Airmen*: The heart of combat capability***
- **Integrating Operations: *Maximizing combat capabilities***
- **Technology-to-Warfighting: *The tools of combat capability***

"Maintaining our edge as the preeminent Air and Space Force in the world, providing America's asymmetric advantage for protecting our national interests."

JOHN P. JUMPER
General, USAF
Chief of Staff

U.S. AIR FORCE

Air Force Transformation Concepts of Operations (CONOPs)

- AIR AND SPACE EXPEDITIONARY FORCES
- GLOBAL STRIKE
- SPACE AND C4ISR
- GLOBAL RESPONSE
- HOMELAND SECURITY
- NUCLEAR RESPONSE
- GLOBAL MOBILITY

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Air Force Transformation Goals

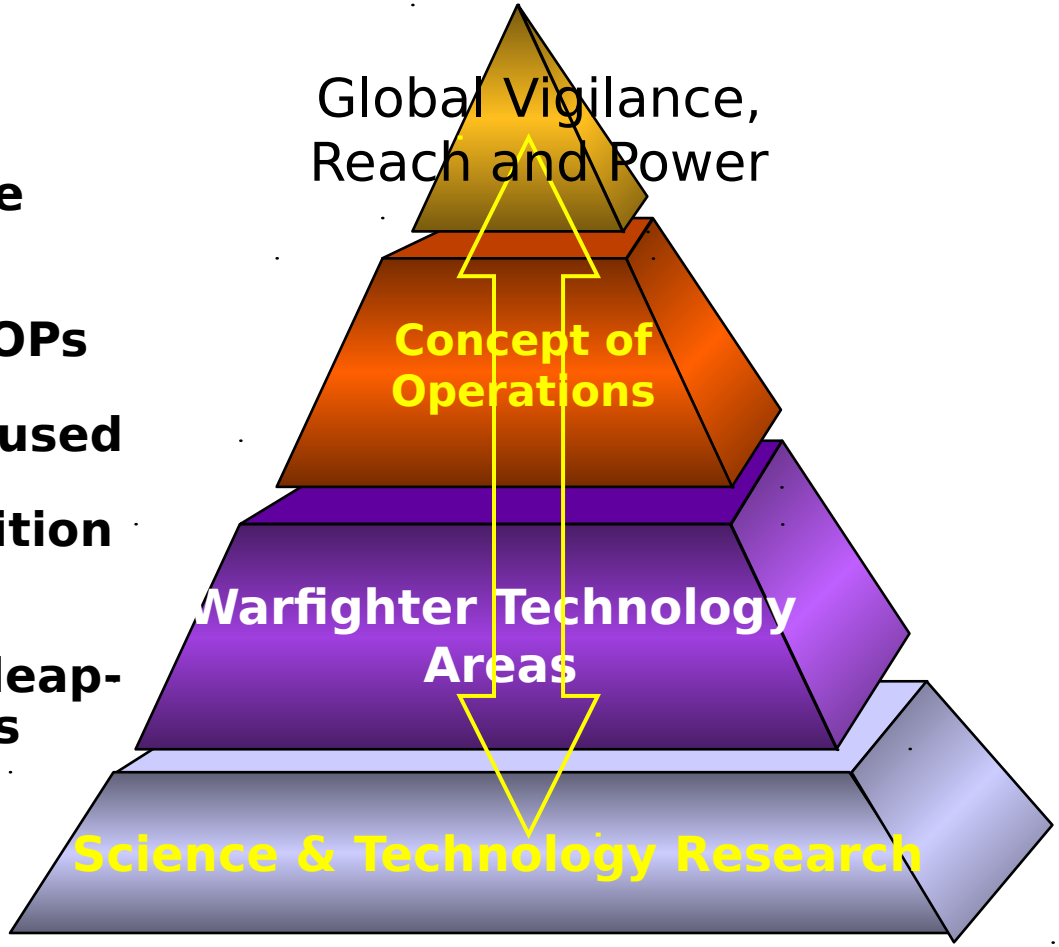
- **INFORMATION SUPERIORITY**
  - Control and exploit information for decision dominance
- **AIR AND SPACE SUPERIORITY**
  - Control air and space
- **PRECISION ENGAGEMENT**
  - Deliver desired effects with minimal risk and collateral damage
- **GLOBAL ATTACK**
  - Engage adversary targets anywhere, anytime
- **RAPID GLOBAL MOBILITY**
  - Rapidly position joint forces for world responsiveness
- **AGILE COMBAT SUPPORT**
  - Sustain responsive, persistent, and effective combat operations

U.S. AIR FORCE

Air Force Science & Technology Program

Air Force S&T . . .

- **Underpins the Air Force Vision**
- **Enables Air Force CONOPs**
- **Program capability focused**
  - **Emphasizing transition to the warfighter**
  - **Funding potential leap-ahead technologies**



U.S. AIR FORCE

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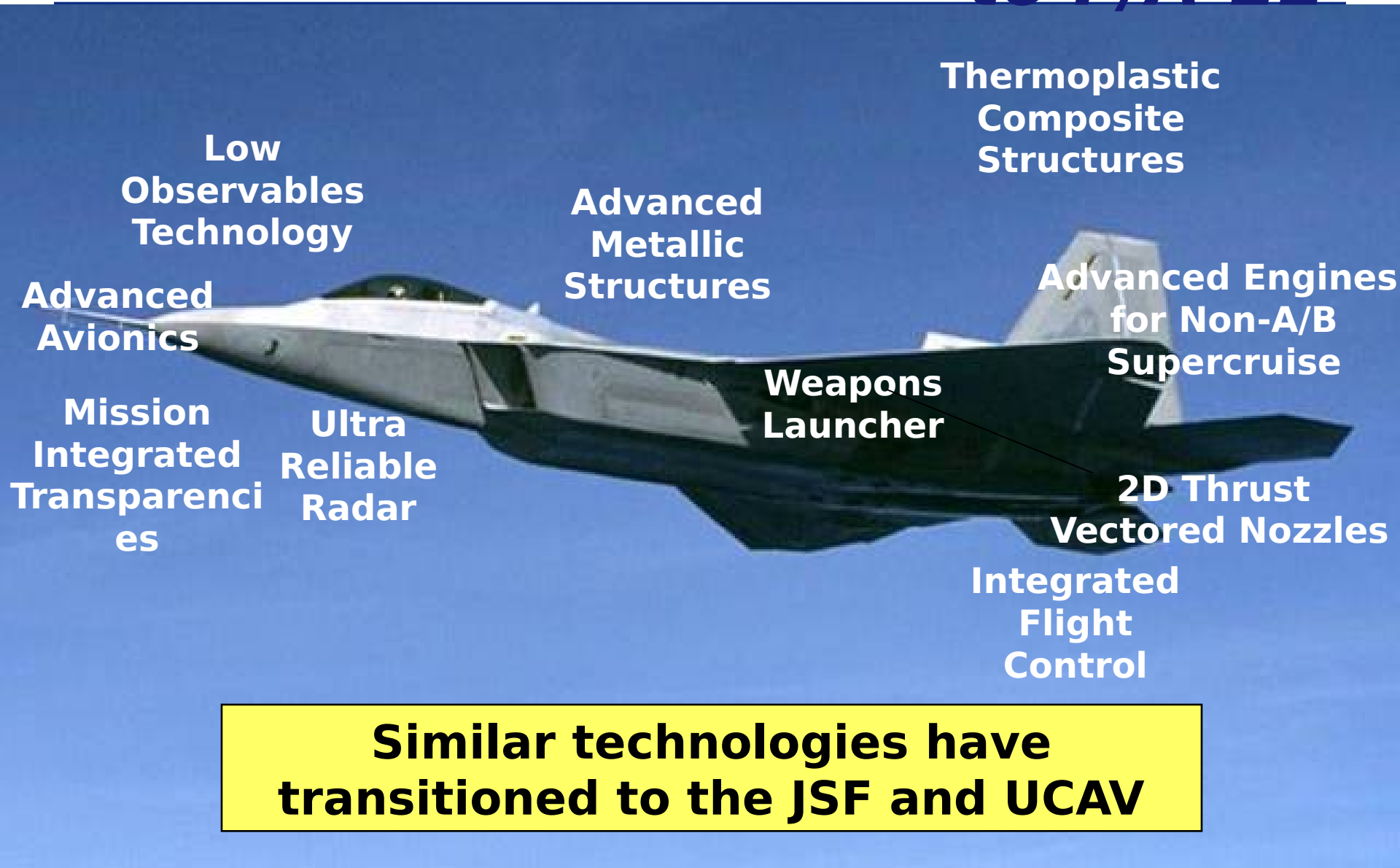
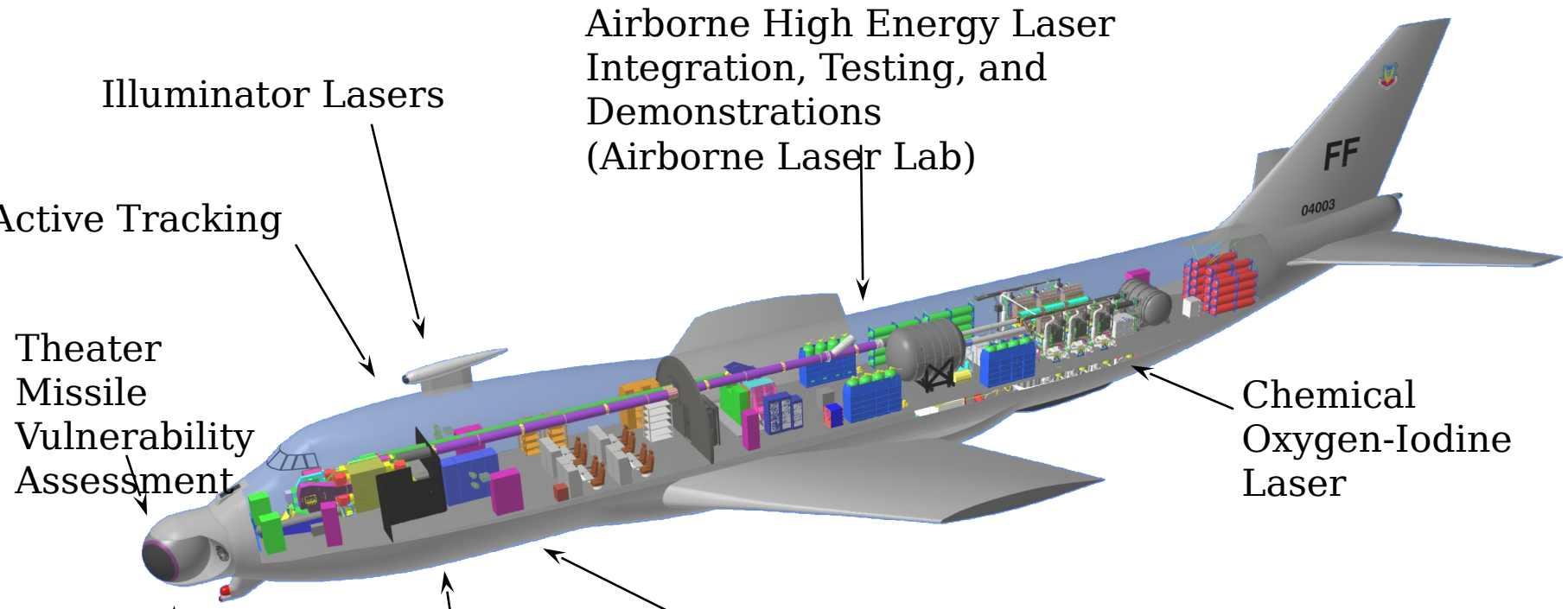
S&T Technology Transitions to F/A-22



Similar technologies have transitioned to the JSF and UCAV

U.S. AIR FORCE

Airborne Laser (ABL)


Airborne High Energy Laser Integration, Testing, and Demonstrations (Airborne Laser Lab)
Illuminator Lasers
Active Tracking
Theater Missile Vulnerability Assessment
Chemical Oxygen-Iodine Laser
Beam Control Components – Windows, High-Reflectivity Mirrors, Deformable Mirrors, Aperture Sharing Elements, Fast Steering Mirrors
Adaptive Optics
Atmospheric Characterization
FF
04003

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Interactive Datawall

- **Interactive Datawall**
  - **Provides Commanders with a precise, comprehensive, and shared view of battlefield operations**
  - **Army's 10th Mountain Division deployed two datawalls to Afghanistan**

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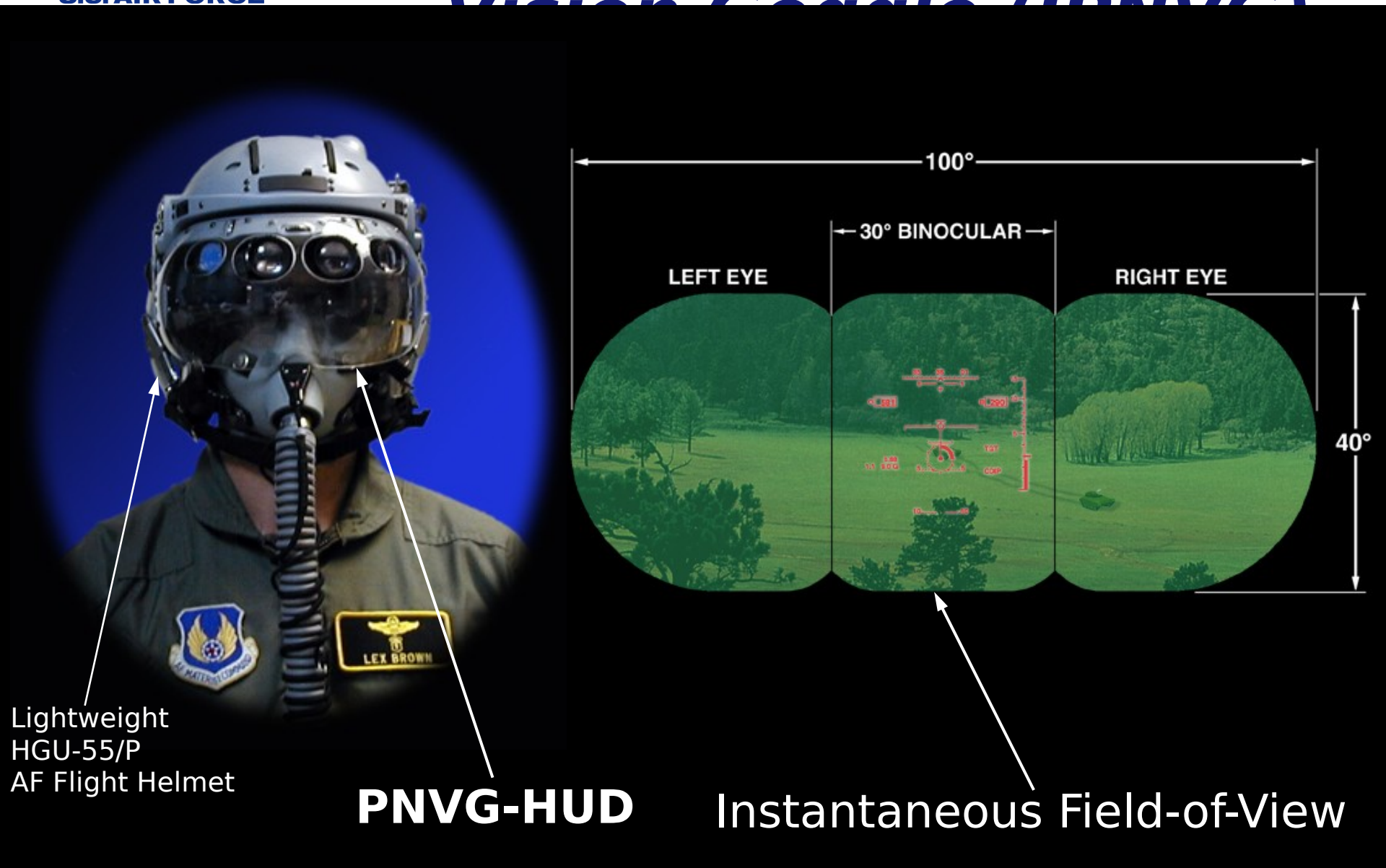
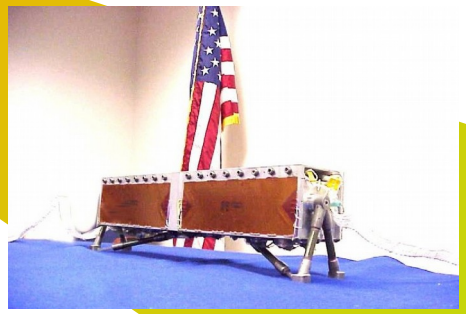
Integrated Panoramic Night Vision Goggle (IPNVG)



Lithium Ion Battery

- Lithium Ion Technology Developed Under Joint AFRL/NASA/JPL Program Transitioned to B-2 and Mars Rovers



- B-2 Batteries >350 Flight Test Hours Logged
- Mars Rover Batteries Fully Operational After 7 Month Cruise Through Space

U.S. AIR FORCE

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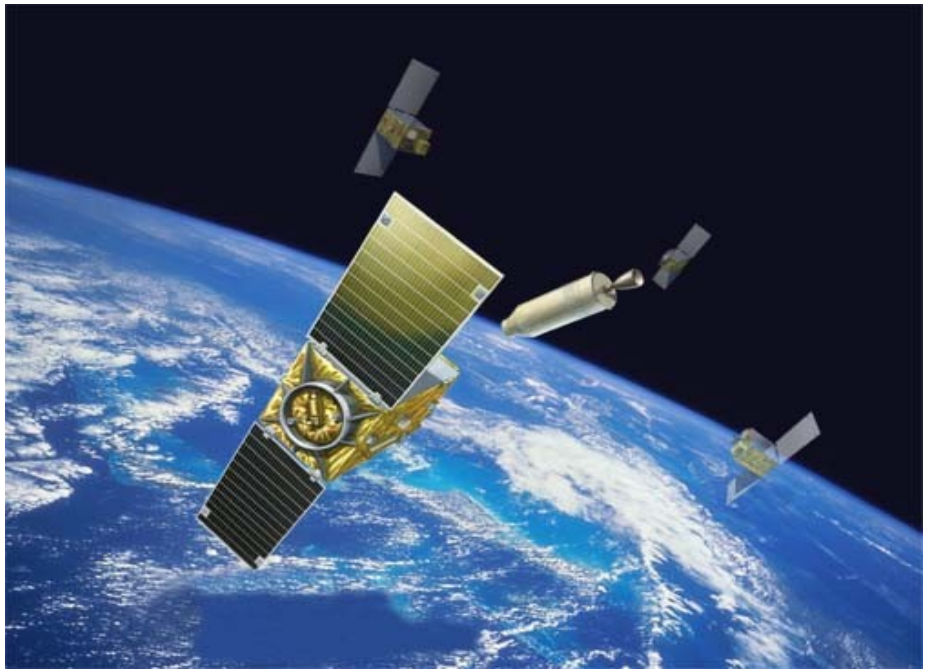
XSS-11 Program Description



- First demonstration of a fully autonomous satellite designed for orbital navigation and inspection
- Demonstrates:
  - Capability to safely rendezvous, navigate around, and inspect
  - Revolutionary mission planning
  - Collision avoidance — space situational awareness

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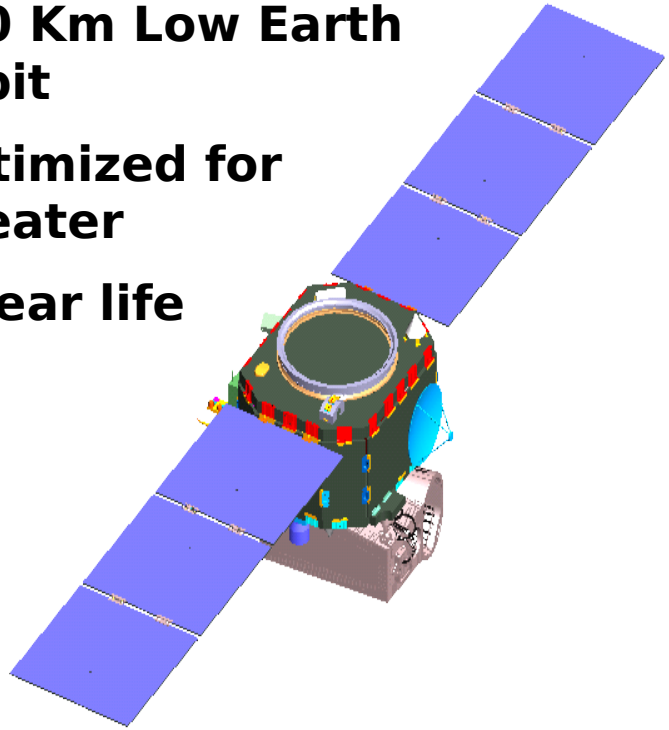
Tactical Satellite - 2

300 Kg

350 Km Low Earth Orbit

Optimized for Theater

1 year life



- **Rapid design, development, and fabrication**
- **On-demand deployment**
- **Intelligence, Surveillance, and Reconnaissance augmentation (Theater node)**
- **Expanded warfighter access via SIPRNET and high rate downlink**

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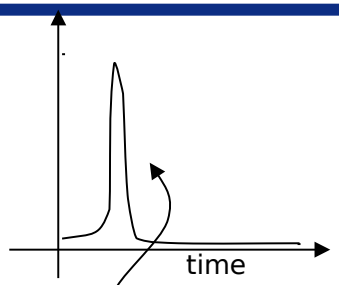
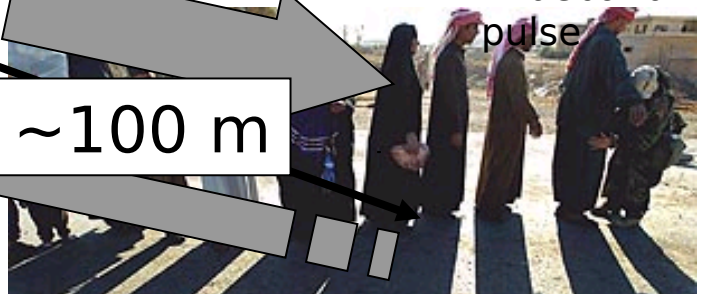
Concealed Weapon Detector

Transmit



Wideband pulse

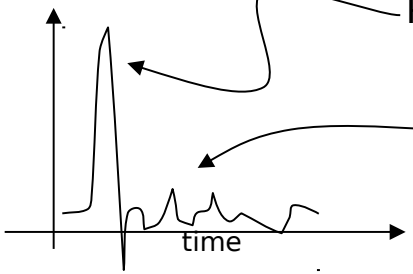
~100 m



Return

Fiber optic link

operator

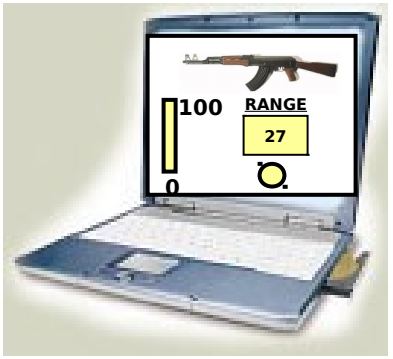


Prompt response

Resonance response

Each metallic component has a specific resonant frequency

Data



Identify

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PING Concealed Weapon Detector

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Battlefield Air Operations (BAO) Kit

- **Reduction of weight by 50%**
- **Digital machine-to-machine connectivity reduces time to transmit data and reduces opportunities for errors**

Transform

Battlefield Air Targeting-Camera Autonomous Micro-air vehicle (BATCAM)

Special Operations Forces Tactical Network (SOFTNET)

Battlefield Air Targeting-Network (BATNET)

Laser Integrated Target Engagement System (LITES)

Battlefield Renewable Integrated Tactical Energy System (BRITES)

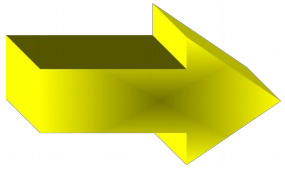
Combined Air Operations Center

Battlefield Air Targeting, Man-Aided kNowledge (BATMAN)

U.S. AIR FORCE

Outline

- Transformation
- Legacy S&T
- Near-Term S&T



- Investment in Future Warfighter Capabilities
- Summary

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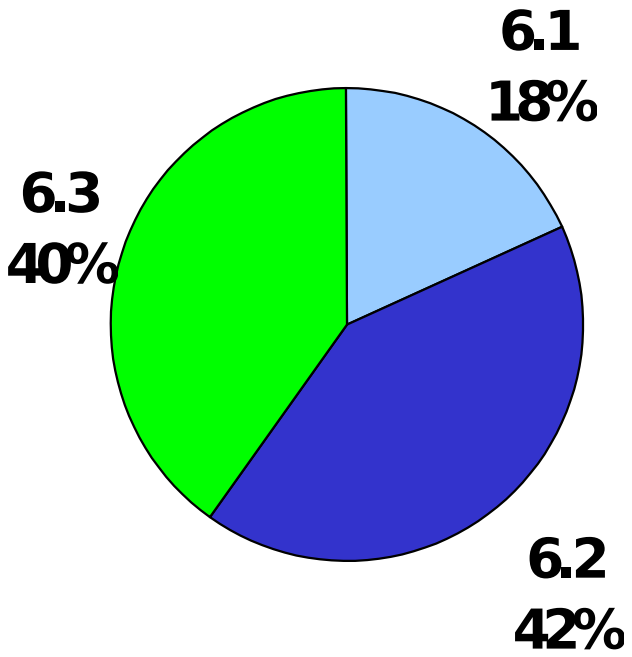
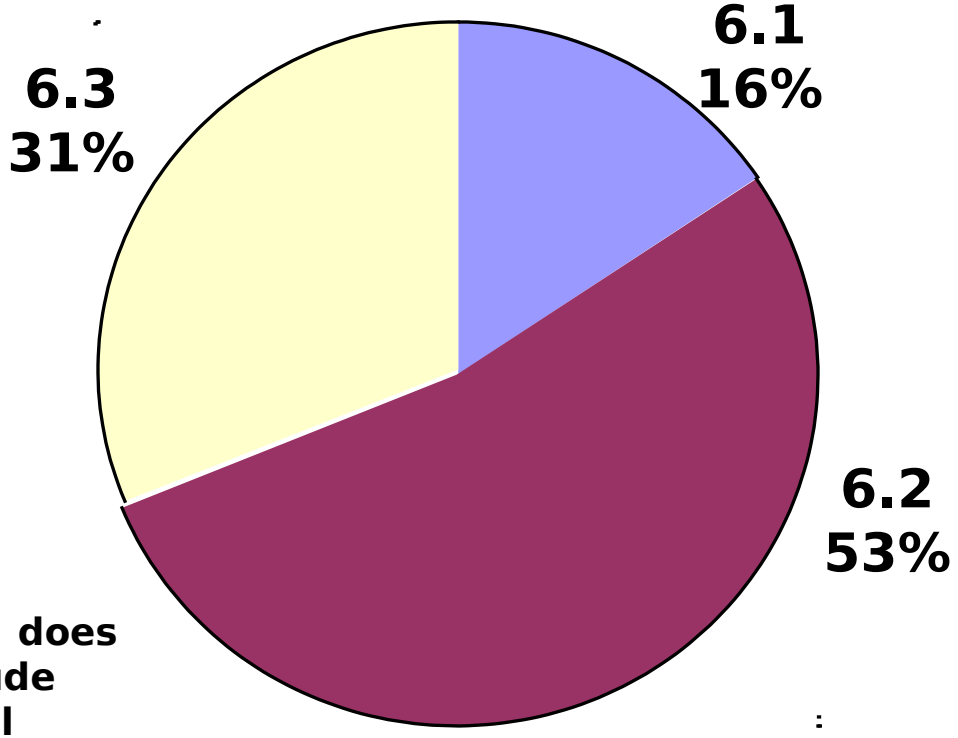
FY05 PB by Budget Activity

Budget Activity	$M
6.1	345.5
6.2	786.2
6.3	763.7
TOTAL	1,895.4



U.S. AIR FORCE

FY05 PB "Core" S&T by Budget Activity

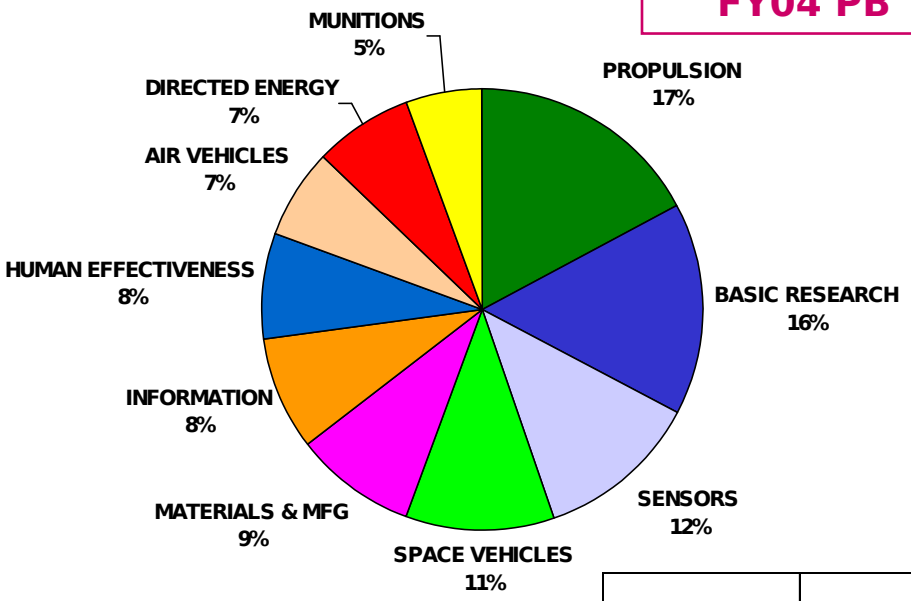


"Core" S&T does not include Special Programs, or Devolved Programs

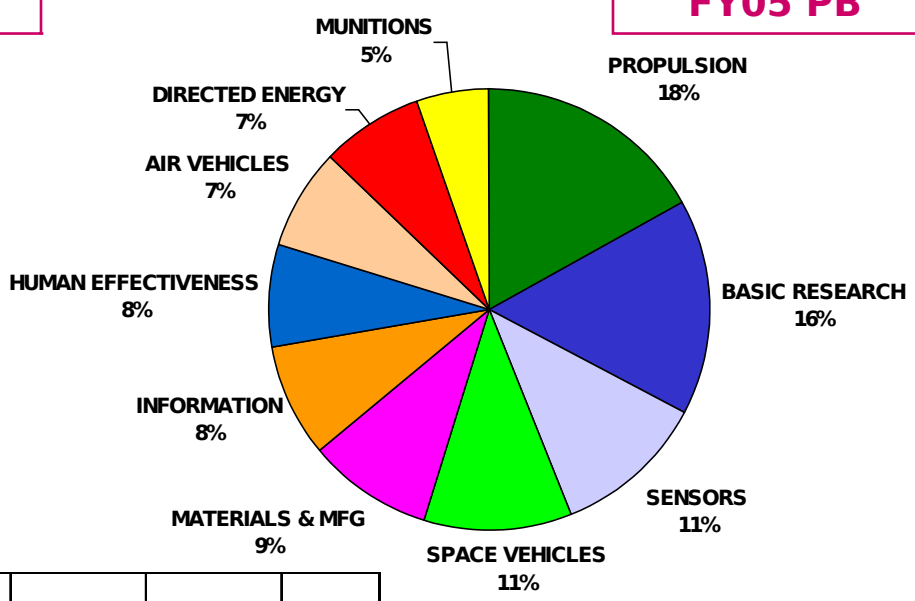
U.S. AIR FORCE

Comparison of "Core" S&T: FY04 PB and FY05 PB by Technology Area

FY04 PB



FY05 PB



FY04 "Core" S&T does not include one-year only NAI funding of $161.5M (PB), $89.3M (APPN)

Tech Area	FY04 PB	FY04 APPN	FY05 PB	FY04 to FY05 PB$ Change
PROPULSION	222.3	265.0	236.1	13.9
BASIC RESEARCH	204.8	214.8	217.3	12.6
SENSORS	153.1	176.1	155.7	2.6
SPACE VEHICLES	142.4	200.8	149.0	6.7
MATERIALS & MFG	114.1	185.2	129.4	15.4
INFORMATION	108.3	131.7	115.6	7.3
HUMAN EFFECTIVENESS	101.3	131.1	104.3	3.0
AIR VEH	89.1	108.2	103.8	14.7
DIRECTED ENERGY	93.4	182.1	101.6	8.2
MUNITIONS	71.0	78.0	74.6	3.7
TOTAL	1,299.7	1,672.9	1,387.6	88.0

"Core" S&T does not include Special Programs, Dual Use, or Devolved Programs

NUMBERS MAY NOT ADD DUE TO ROUNDING

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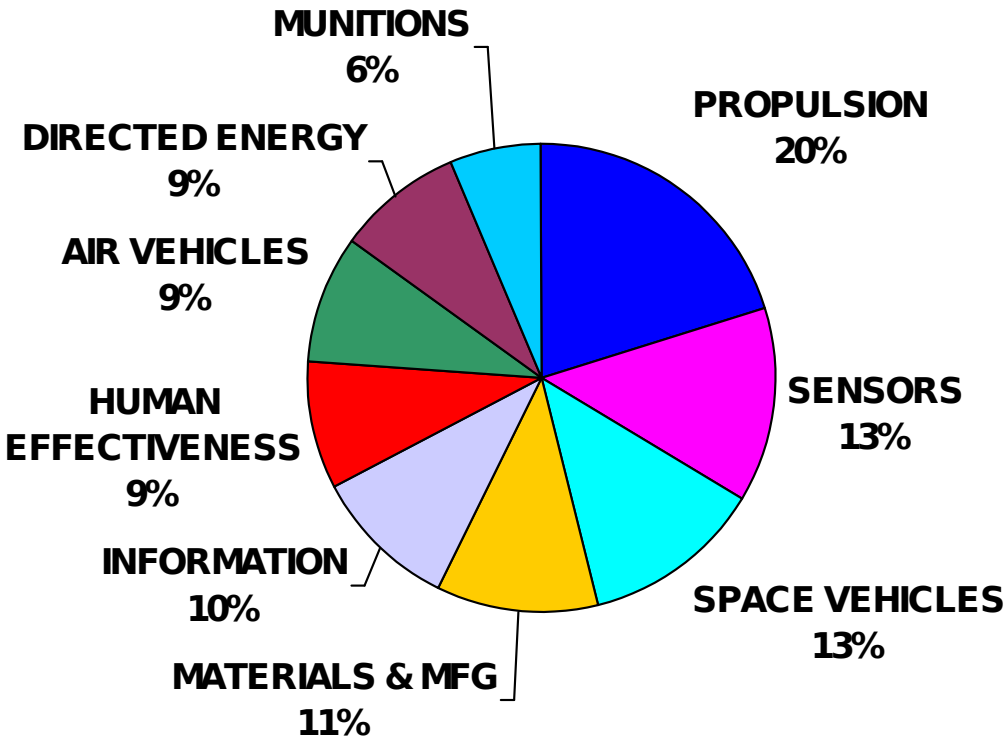
AF S&T FY05 PB
Core 6.2 and 6.3

Tech Area	FY05 PB
PROPULSION	236.1
SENSORS	155.7
SPACE VEHICLES	149.0
MATERIALS & MFG	129.4
INFORMATION	115.6
HUMAN EFFECTIVENESS	104.3
AIR VEHICLES	103.8
DIRECTED ENERGY	101.6
MUNITIONS	74.6
TOTAL	1,170.3

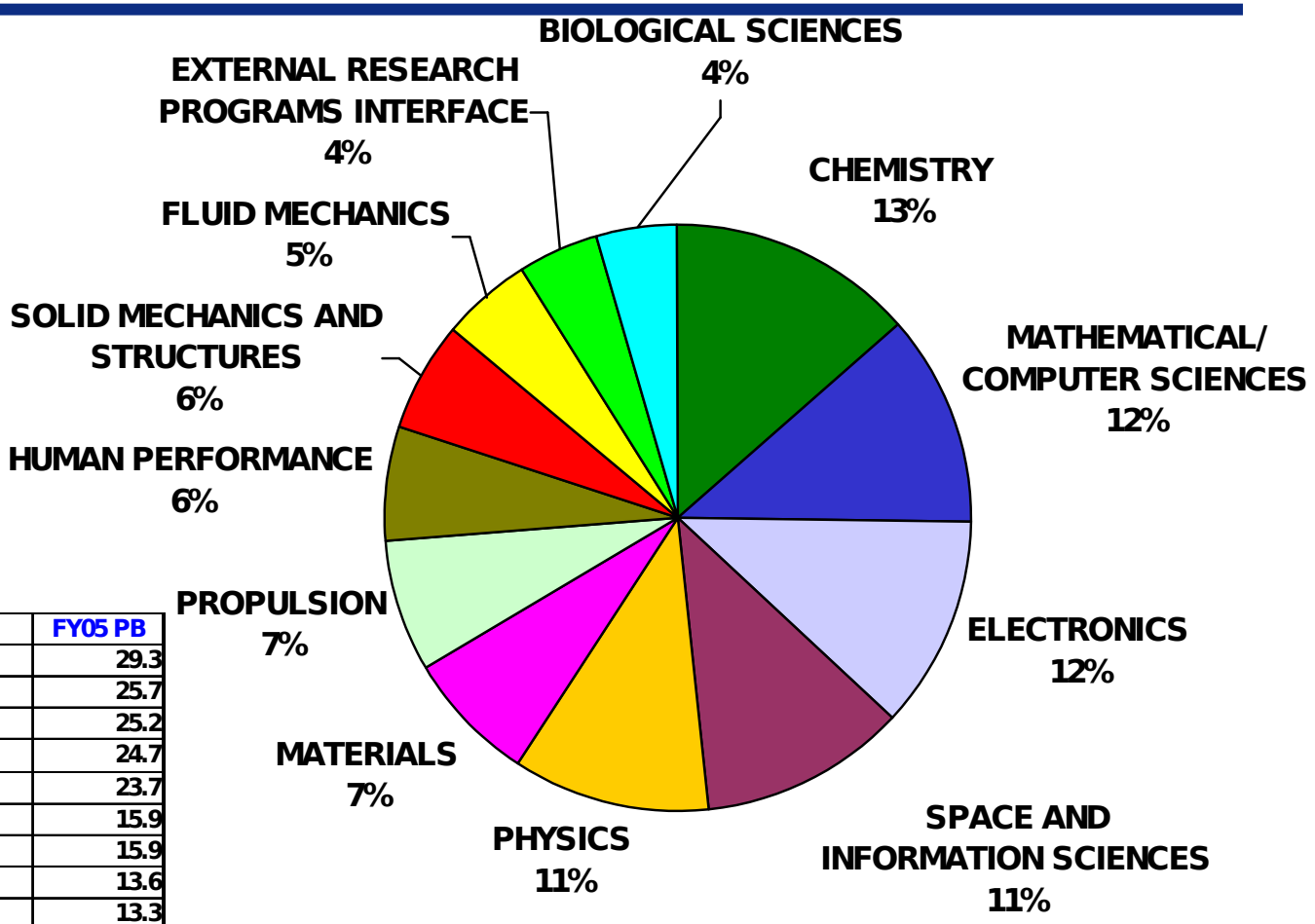


Does not include Budget Activity 6.1, Devolved Programs, Dual Use, or Special Programs

Numbers may not add due to rounding

U.S. AIR FORCE

AF S&T FY05 PB
Defense Research Sciences



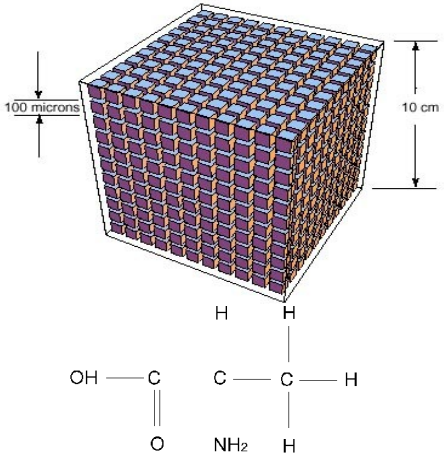
Defense Research Sciences	FY05 PB
CHEMISTRY	29.3
MATHEMATICAL/COMPUTER SCIENCES	25.7
ELECTRONICS	25.2
SPACE AND INFORMATION SCIENCES	24.7
PHYSICS	23.7
MATERIALS	15.9
PROPULSION	15.9
HUMAN PERFORMANCE	13.6
SOLID MECHANICS AND STRUCTURES	13.3
FLUID MECHANICS	10.9
EXTERNAL RESEARCH PROGRAMS INTERFACE	9.6
BIOLOGICAL SCIENCES	9.6
TOTAL	217.3

Numbers may not add due to rounding

U.S. AIR FORCE

Quantum Computation

Prototype QC using NMR



Objectives

- Develop near-term quantum computer implementations
- Develop algorithms to model physical systems
- Explore architectures to scale a large array of small quantum computers

Approach

- Implementation of a “type-II” quantum computer
- Explore nuclear magnetic resonance technologies
- Implement and test quantum lattice-gas algorithms

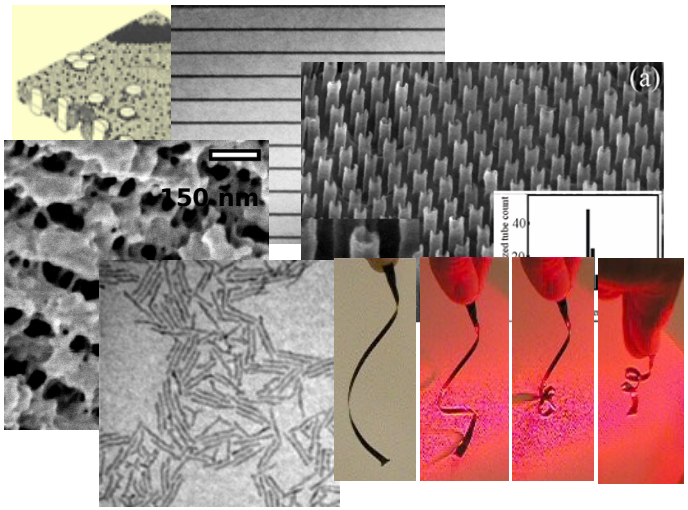
Payoffs

- 10^6 faster atomic-level computing
- Fast solutions of complex fluid dynamics problems
- Faster image reconstruction signal processing

U.S. AIR FORCE

Nano-Tailored Materials Program

- **Providing nano-tailored materials that enable:**
  - **Multi-functionality**
    - **Electromagnetic shielding, smart fabrics, and remotely actuated structure deployment (munitions, satellites, and aircraft)**
  - **Active material systems**
    - **Displays, sensors, tunable detectors, self-adaptive lubricants, embedded sensors, and self-diagnostic components**



Focused R&D

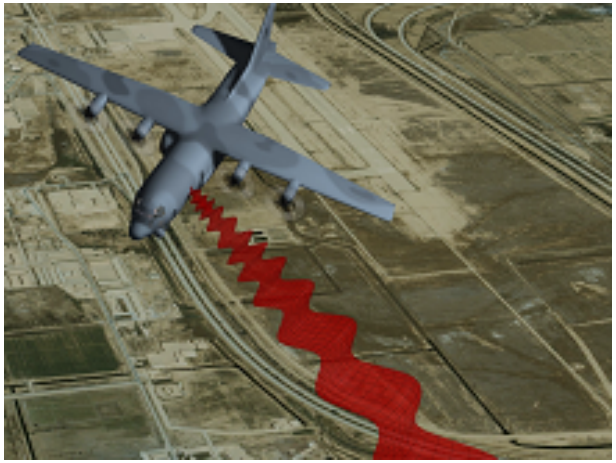
Revolutionary System Capabilities

U.S. AIR FORCE

Active Denial Technology

Field Tested System

- Non-lethal, anti-personnel DE weapon
- Causes intense pain but not damage
- Outranges effective small arms fire
- Many potential platforms
- Air Force developed technology
- Funded by Joint Non-Lethal Weapons Directorate & AF
- Repel effect safely demonstrated on hundreds of volunteers
- Passed preliminary legal review



Airborne Active Denial System

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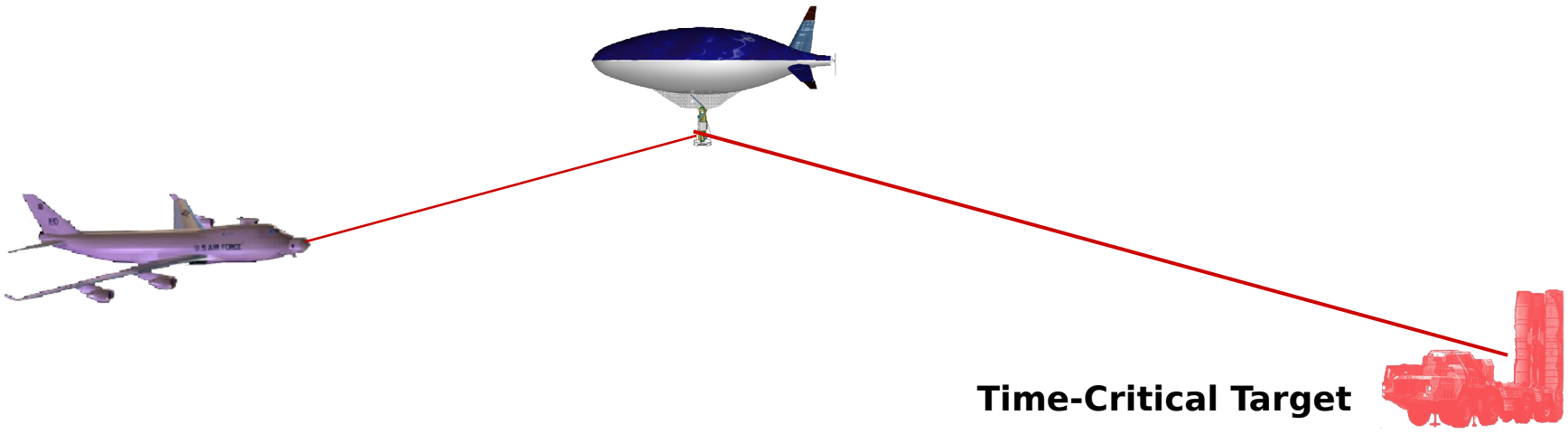
Relay Mirrors

Unique capabilities

- Extends laser range
- Above most optical turbulence

Many potential missions

- Surveillance/tracking
- Missile defense
- Deny, degrade, or destroy targets



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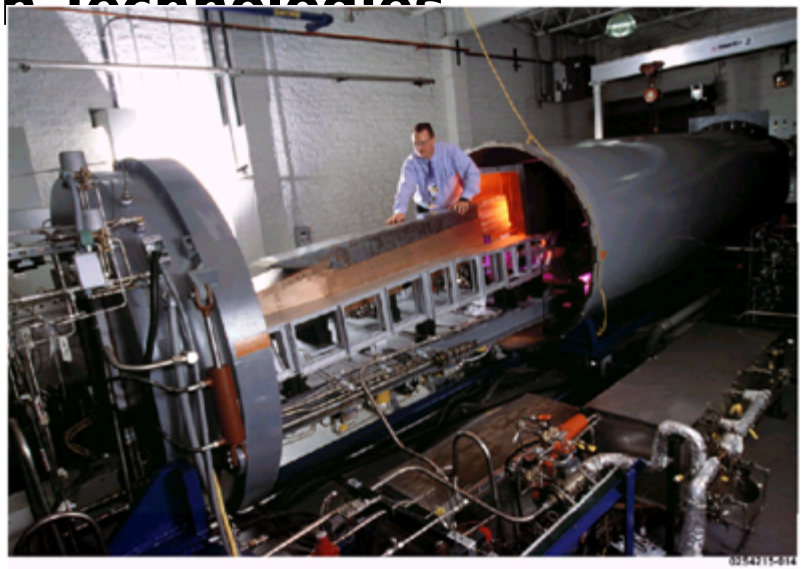
More Speed

- Hypersonic Technology Development
  - Scramjet Design and Operation
  - Fuels and Thermal Management Development
  - Modeling and Simulation Processes and Equipment
  - Ground Test Demonstrations
- Scramjet Flight Demonstration Technologies



Scramjet Ground Demonstration Engine in Test Cell

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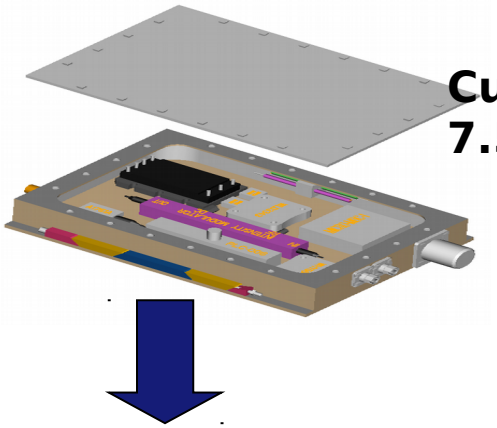
A New Paradigm for Intelligence, Surveillance, and Reconnaissance

Airborne ISR Designed Around The Sensors …

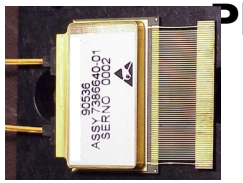
… Not "Shoehorned" Into Existing Platform

U.S. AIR FORCE

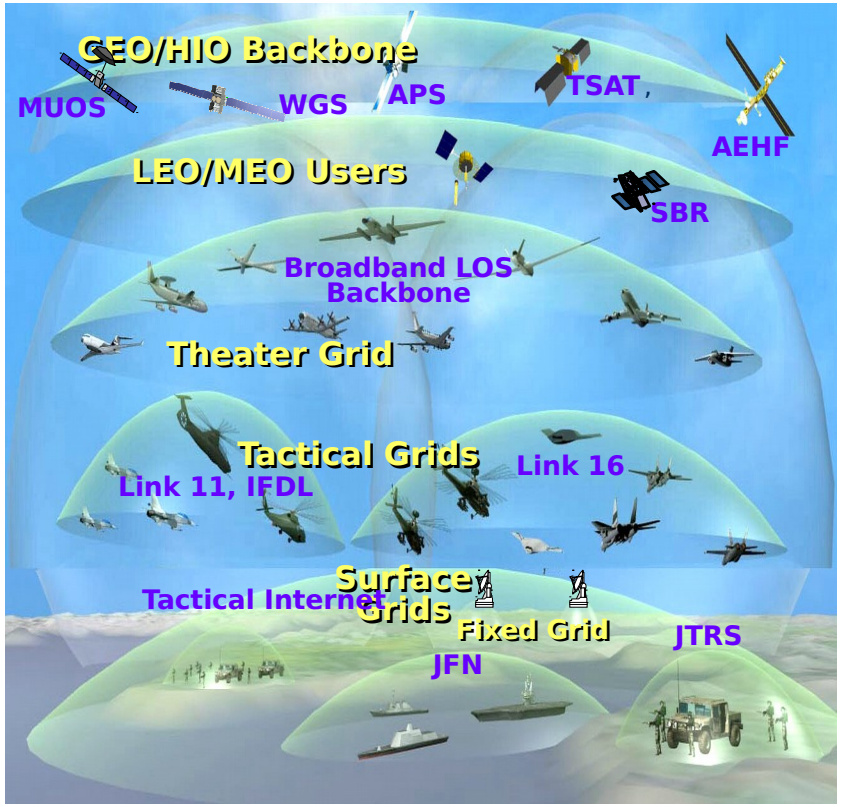
Information Super Highway



Current Device
7.5” x 5.5” x 1.2”



Photonic Integrated Circuit
for
Optical Networking
1.0” x 1.5” x .25”



Removing communications as a constraint to the user

U.S. AIR FORCE

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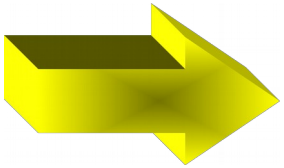

- Summary

U.S. AIR FORCE

Summary

- **Air Force S&T aggressively pursuing high payoff technologies for transformational capabilities**
- **Capability-Based Planning for S&T**
- **Focused on Current and Future Warfighting Capabilities**

Air Force transformation is a journey — not a destination…

U.S. AIR FORCE

Future Battlespace

"Innovation within the armed forces will rest on experimentation with new approaches to warfare, strengthening joint operations, exploiting U.S. intelligence advantages, and taking full advantage of science and technology….."